

# Landsat Products Development

Continued increases in the impact of the Landsat Program are dependent on an expanded range of successfully implemented products

An expanded suite of products improves the science relevance of the Landsat Program

Initial focus on “enabling” products:

- surface reflectance

- surface temperature

- clouds, cloud shadows, snow ...

Later focus on science products

- land cover, change, lai, albedo, .....

# Surface Reflectance

## Current Status:

We have an existing approach (LEDAPS) that has been available and has been used fairly widely in the community (distributing software)

There is another alternative approach (using MODIS products) that would be useful for part of the history of the Landsat Program that may be a slight improvement

# Surface Reflectance

Path Forward (Science Team Recommendations):

1. On a trial basis, implement LEDAPS for production of surface reflectance datasets (EDC)
  1. EDC prototype a limited area database by June 2011)
  2. Evaluate possible algorithm improvements, including implementation of the MODIS-based algorithm for post 2000 data
2. GOAL #1: Operational Implementation of Surface Reflectance Products for past and existing sensors by the end of the term of this science team
3. GOAL #2: Routine Production of Surface Reflectance as part of LDCM processing

# Clouds and Cloud Shadows

Current status:

preliminary comparisons of algorithms in Boston in

Nov

recognized need for improved “ground truth” data to  
support comparisons

David Roy's troops are improving the cloud and  
shadow masks

# Clouds and Cloud Shadows

Steps forward (continued):

1. push forward comparison of single date approaches  
finish improvement of cloud and shadow masks  
EDC translate test images to L1T  
recalibrate some of the algorithms (Pat's and David's)  
do formal comparisons of methods  
make recommendations for implementation (at least

testing

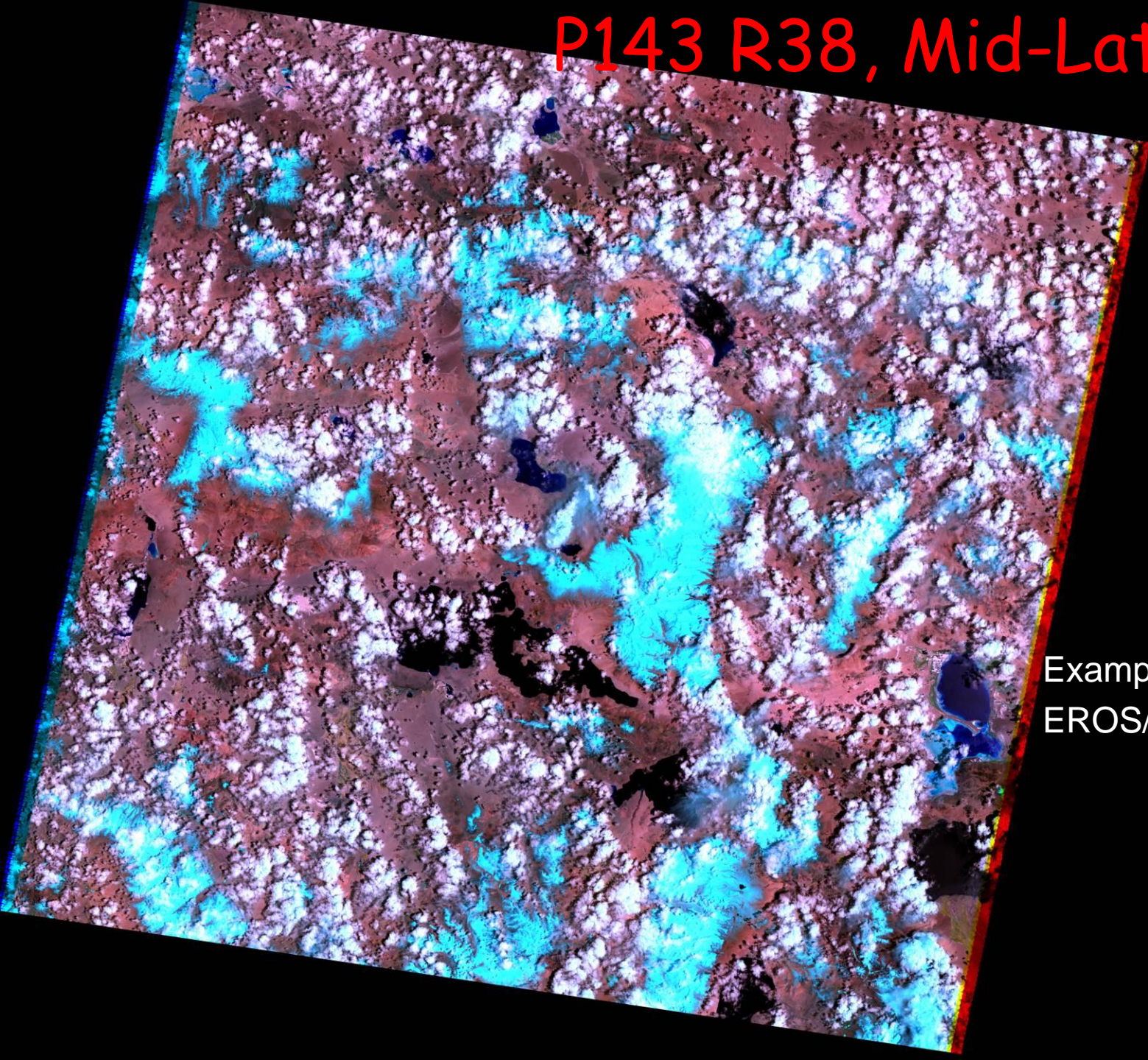
2. begin process of development of multitemporal approaches  
ultimately likely to be a better solution  
will require some fundamental changes in processing

GOAL: Routine production of and provision of cloud and cloud shadow masks (hopefully the science team can provide guidance on approaches for implementation prior to the end of the current term)

# Status of WELD Refinement of all the EROS/Irish Landsat Cloud L1G scenes

Zone	Current Status	Original # of scenes	# with no clouds	# cloud mask fixed	# too complex to fix	# with shadows digitized	# shadows failed SDSU QA	# scenes to fix
Mid-Lat. North	Shadows fixed Cloud mask fixed	24	7	14	1	16	2	0
Sub- Tropical North	Shadows fixed Cloud mask check in progress	24	13	2	1	10	0	8
Boreal	Shadows fixed Cloud mask check in progress	24	2	2	4	18	2	14
Tropical	Shadows fixed Cloud mask not yet checked	22	4	0	9	9	0	9
Mid-Lat. South	Shadows fixed Cloud mask not yet checked	24	3	0	5	16	1	15
Sub- Tropical South	Shadows fixed Cloud mask not yet checked	23	5	0	4	14	3	11
Polar North	Shadow fixed Cloud mask not yet checked	20	6	0	3	11	5	6
	Total:	161	40	18	27	94	13	63

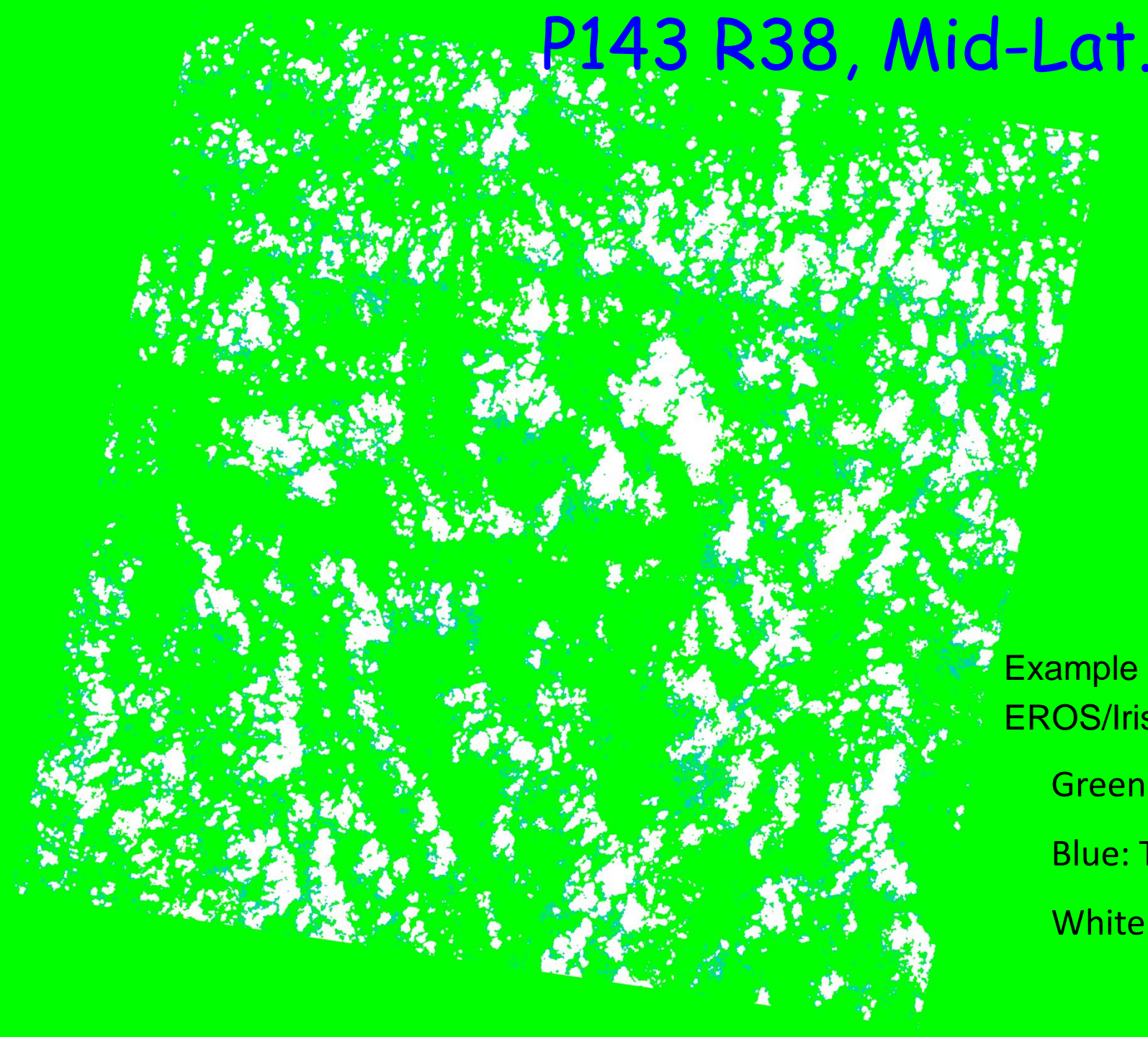
P143 R38, Mid-Lat. North



Example  
EROS/Irish Scene

Band	Color
4	R
3	G
2	B

# P143 R38, Mid-Lat. North



Example

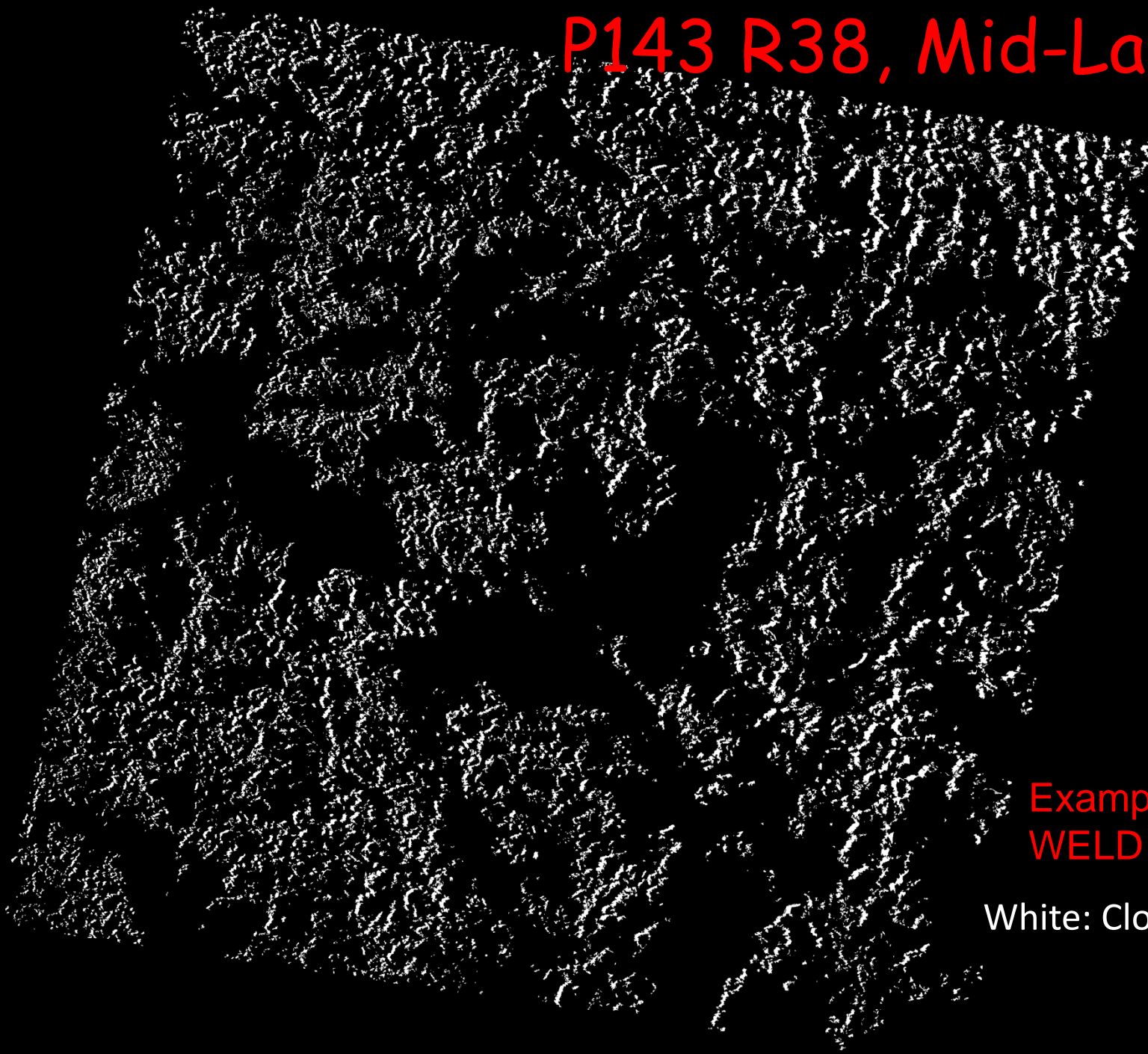
EROS/Irish Cloud Mask

Green: No cloud

Blue: Thin cloud

White: Thick cloud

P143 R38, Mid-Lat. North

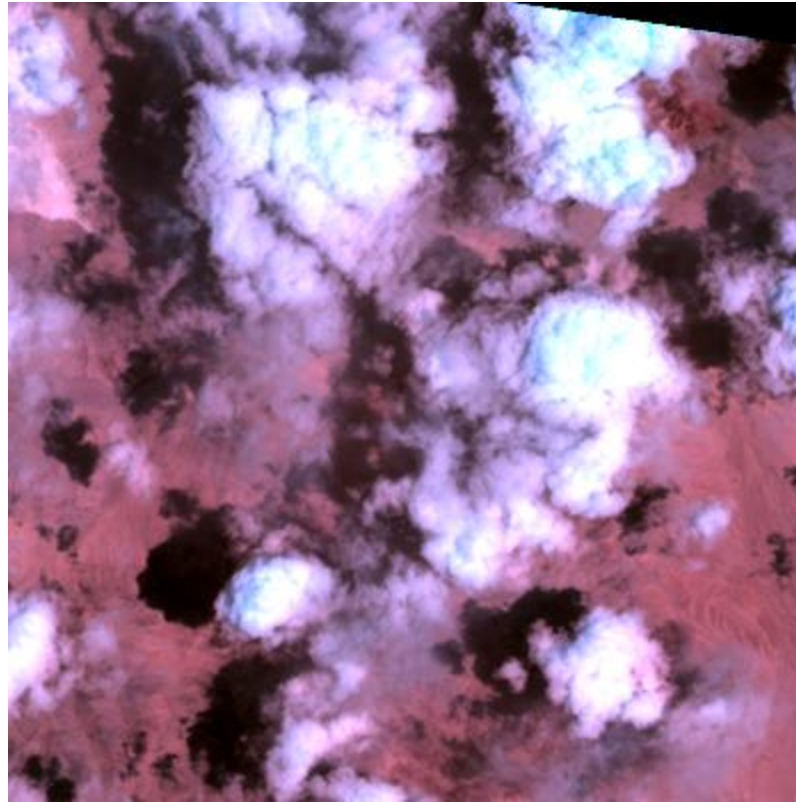


Example  
WELD Shadow Mask

White: Cloud Shadows

# P143 R38, Mid-Lat. North EROS/Irish Scene

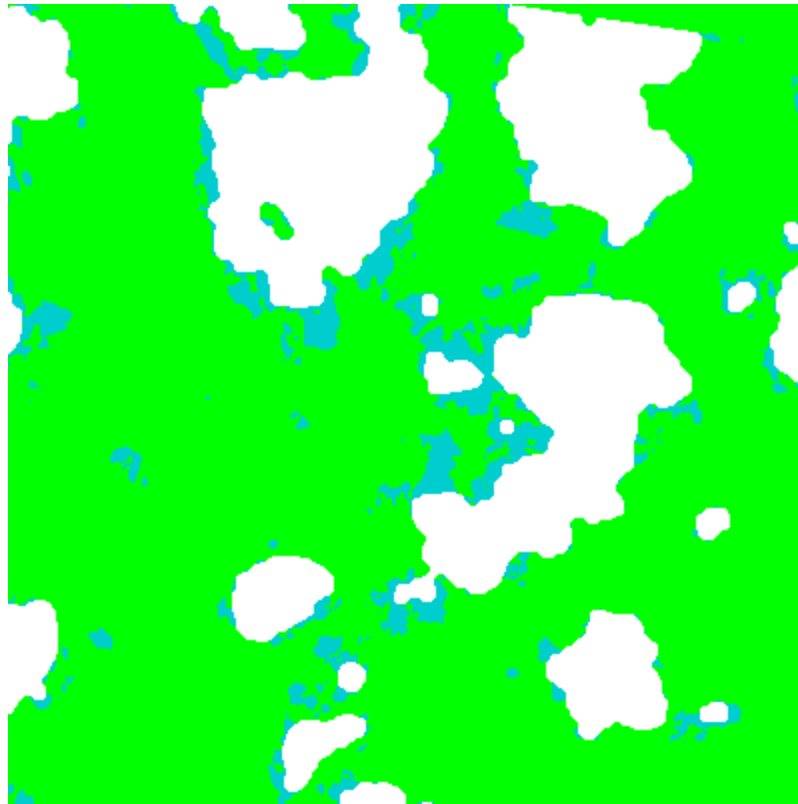
Band	Color
4	R
3	G
2	B



Detail: 400 x 400 pixels

# P143 R38, Mid-Lat. North EROS/Irish Cloud Mask

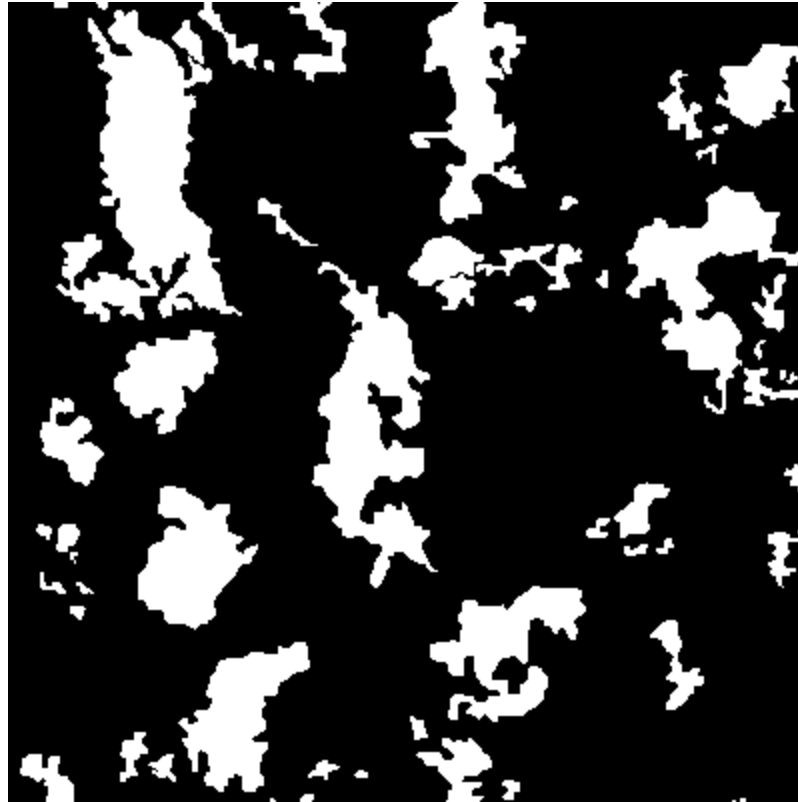
Green: No cloud  
Blue: Thin cloud  
White: Thick cloud



Detail: 400 x 400 pixels

# P143 R38, Mid-Lat. North WELD Shadow Mask

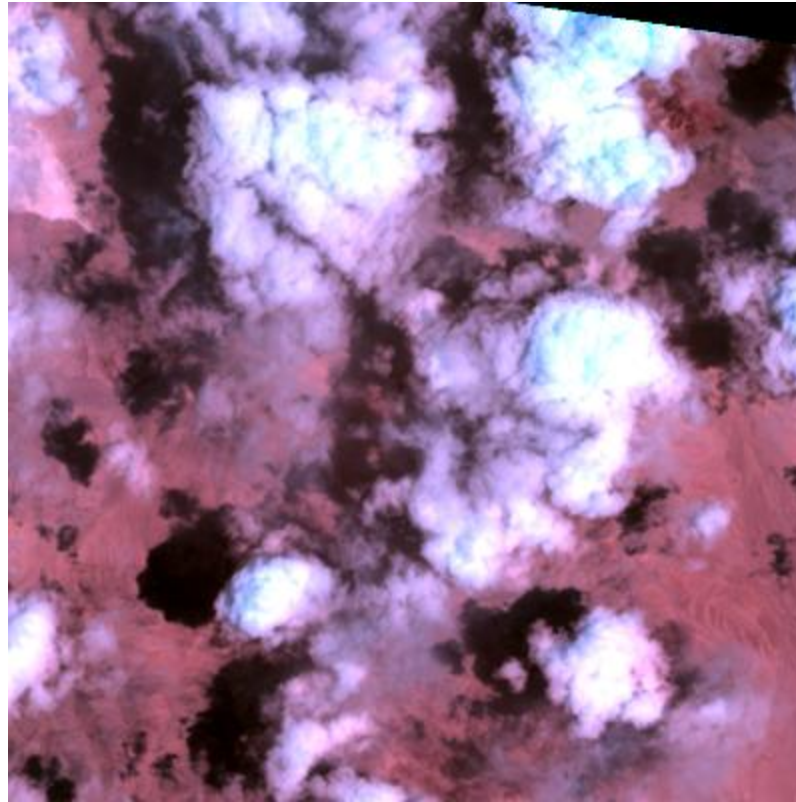
White – Cloud Shadows



Detail: 400 x 400 pixels

# P143 R38, Mid-Lat. North EROS/Irish Scene

Band	Color
4	R
3	G
2	B

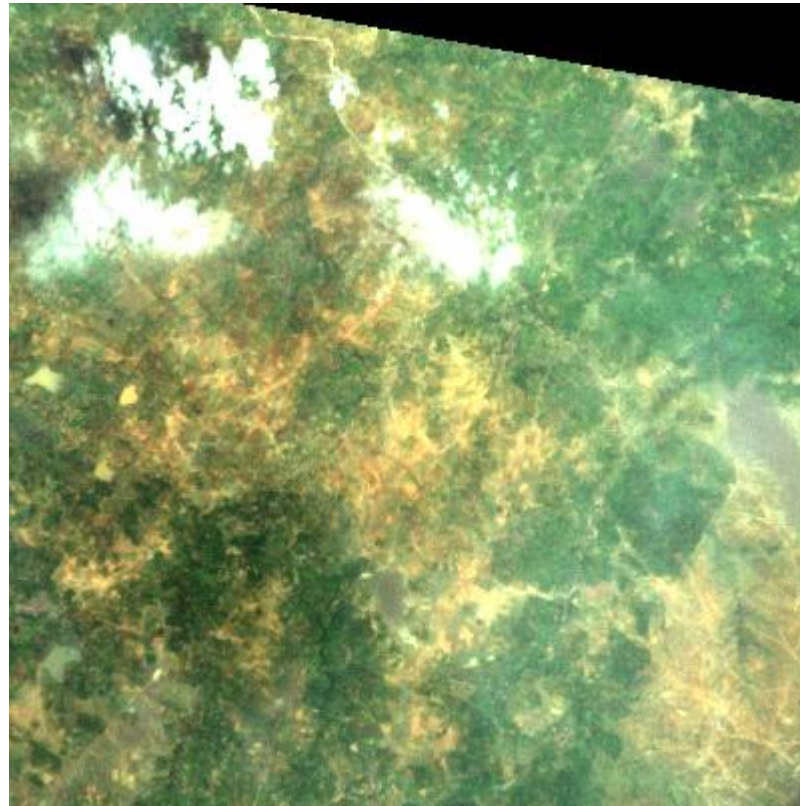


Detail: 400 x 400 pixels

# P145 R43, Cloud Mask

## EROS Irish Cloud Mask - **Commission Example**

Band	Color
3	R
2	G
1	B



These kinds of errors are rare

Detail: 400 x 400 pixels

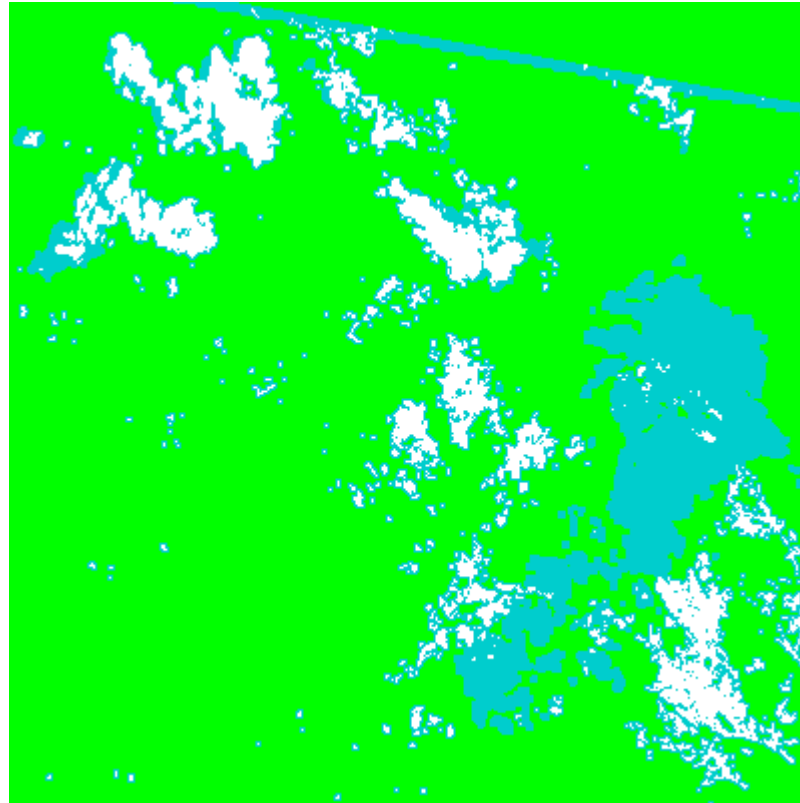
# P145 R43, Cloud Mask

## EROS Irish Cloud Mask - Commission Example

Green: No cloud

Blue: Thin cloud

White: Thick cloud



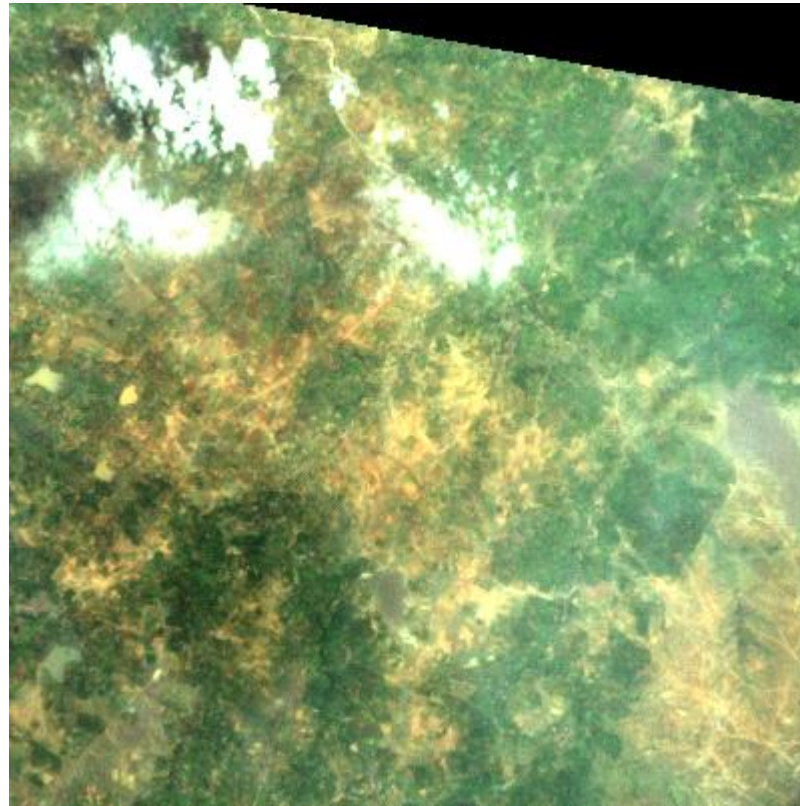
These kinds of errors are rare

Detail: 400 x 400 pixels

# P145 R43, Cloud Mask

## EROS Irish Cloud Mask - **Commission Example**

Band	Color
3	R
2	G
1	B



These kinds of errors are rare

Detail: 400 x 400 pixels

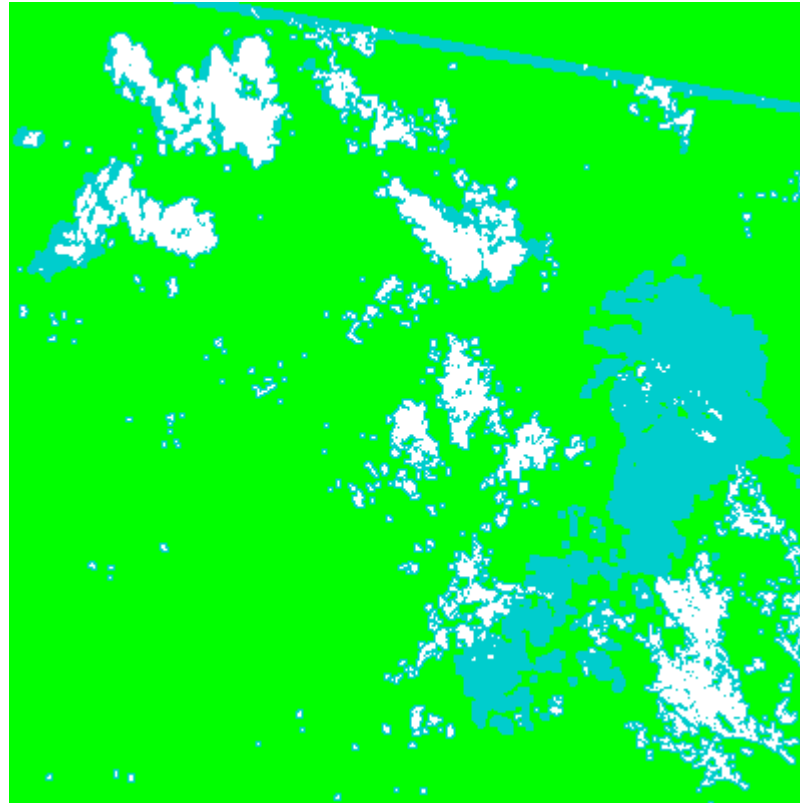
# P145 R43, Cloud Mask

## EROS Irish Cloud Mask - Commission Example

Green: No cloud

Blue: Thin cloud

White: Thick cloud



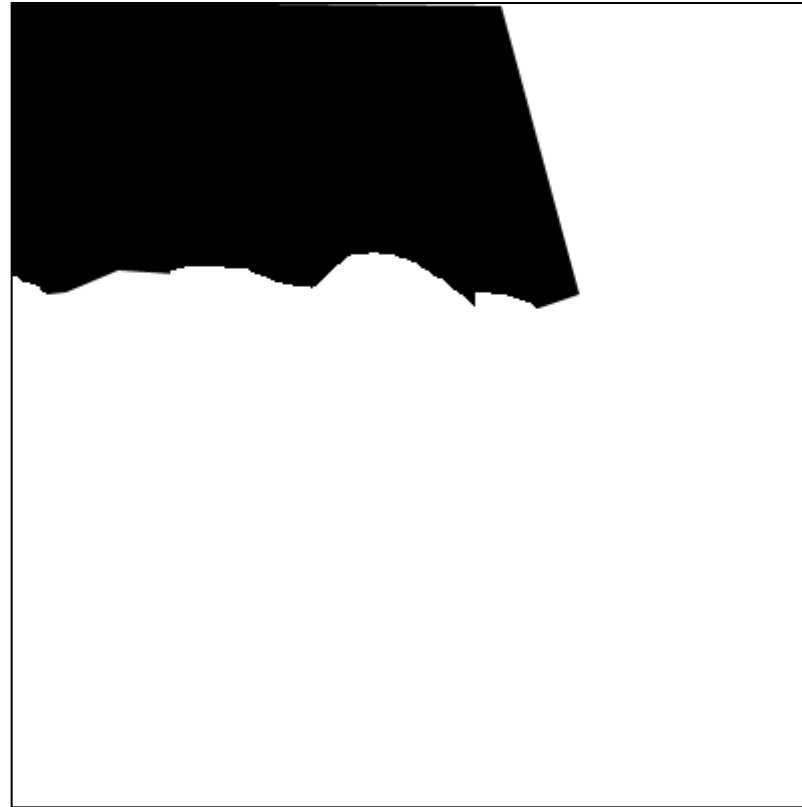
These kinds of errors are rare

Detail: 400 x 400 pixels

# P145 R43, Cloud Mask

## WELD fix of **Commission** Example

White – Not clouds

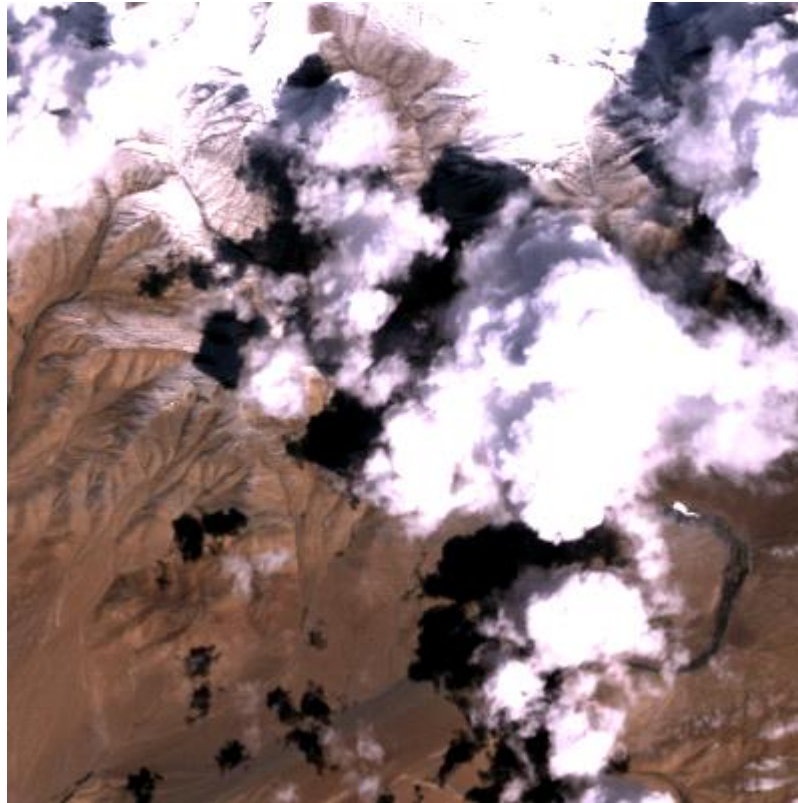


400 x 400 pixels

# P147 R35, Cloud Mask

## EROS Irish Cloud Mask- Omission Example

Band	Color
3	R
2	G
1	B



These kinds of errors are frequent but typically small in spatial extent

Detail: 400 x 400 pixels

# P147 R35, Cloud Mask

## EROS Irish Cloud Mask- Omission Example

Green: No cloud  
Blue: Thin cloud  
White: Thick cloud



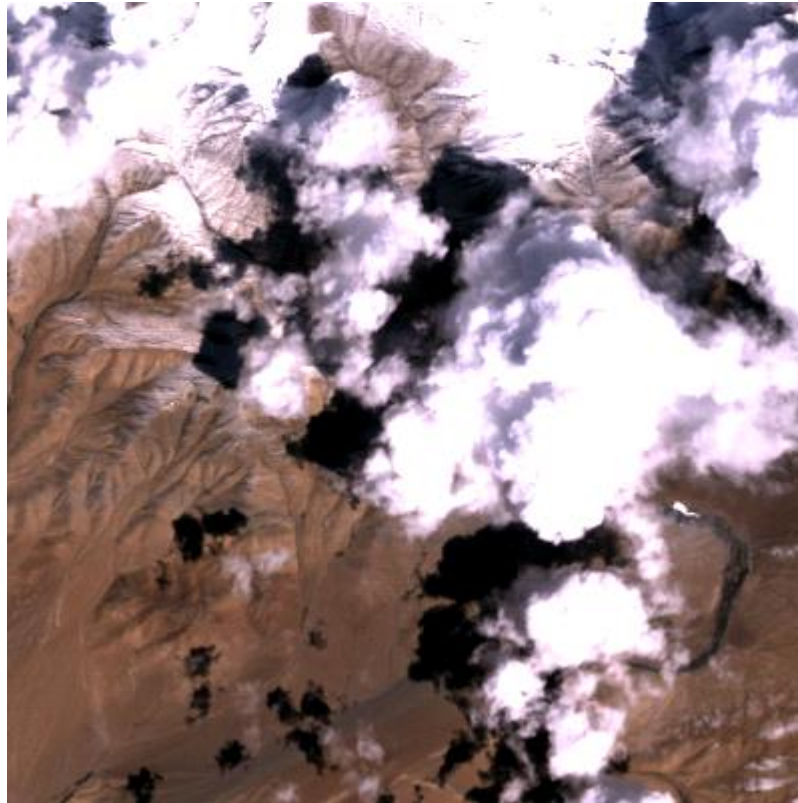
These kinds of errors are frequent but typically small in spatial extent

Detail: 400 x 400 pixels

# P147 R35, Cloud Mask

## EROS Irish Cloud Mask- Omission Example

Band	Color
3	R
2	G
1	B



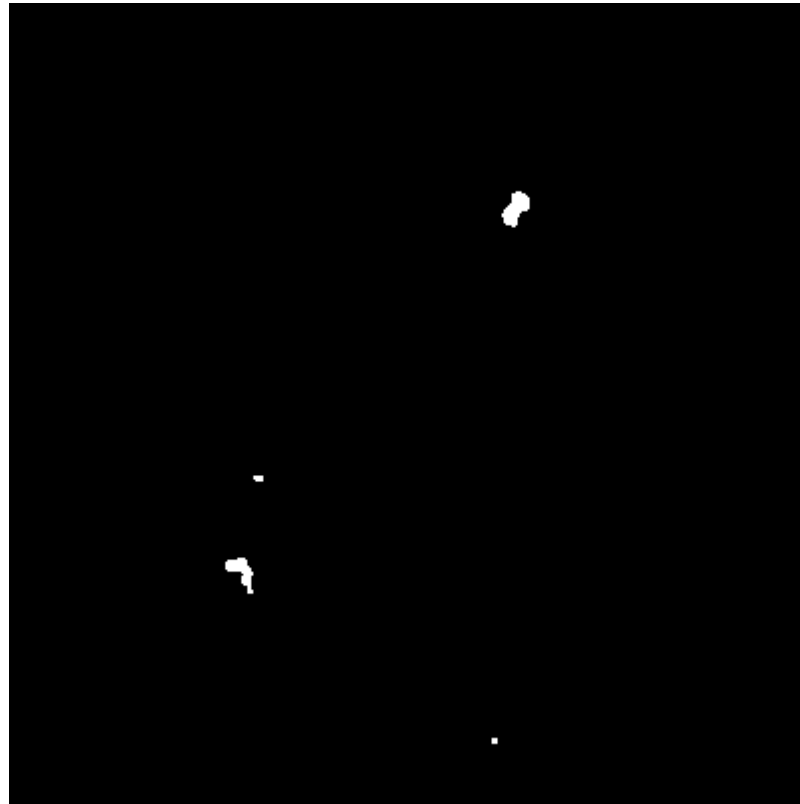
These kinds of errors are frequent but typically small in spatial extent

Detail: 400 x 400 pixels

# P147 R35, Cloud Mask

## WELD fix of Omission

White – Clouds



Detail: 400 x 400 pixels

# P108 R18, Cloud Mask

EROS Irish Cloud Mask - Example of where initially it looks incorrect but it is correct

Band	Color
3	R
2	G
1	B



Detail: 400 x 400 pixels

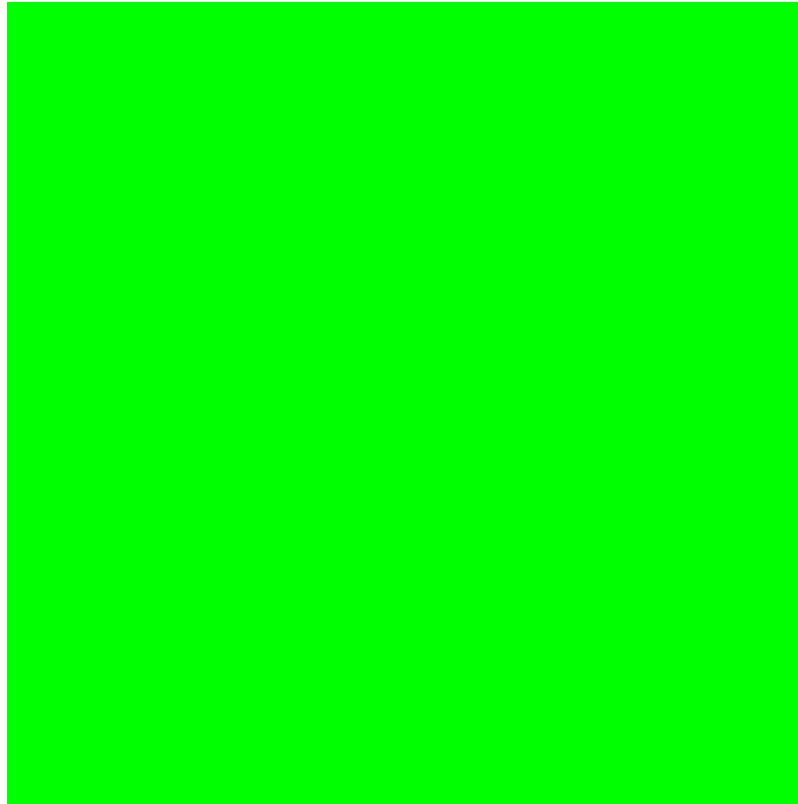
# P108 R18, Cloud Mask

EROS Irish Cloud Mask - Example of where initially it looks incorrect but is correct

Green: No cloud

Blue: Thin cloud

White: Thick cloud



Detail: 400 x 400 pixels

# P108 R18, Cloud Mask

EROS Irish Cloud Mask - Example of where initially it looks incorrect but is correct

Band	Color
3	R
2	G
1	B

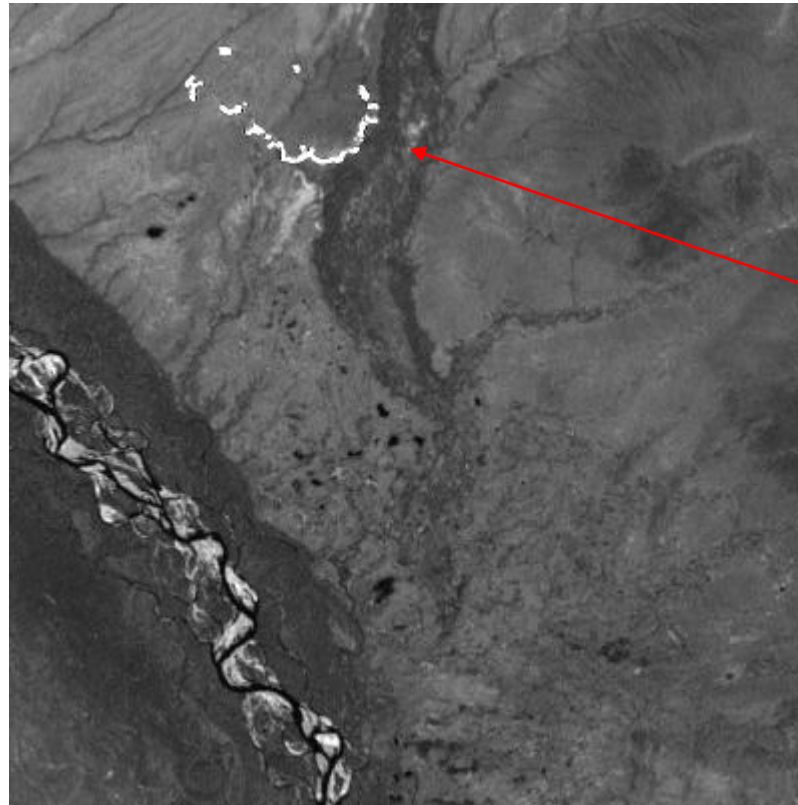


Detail: 400 x 400 pixels

# P108 R18, Cloud Mask

EROS Irish Cloud Mask - Example of where initially it looks incorrect but is correct

Band 7



Saturated band  
7 over fire front

It is smoke not  
clouds

# Fmask

500m browse: cloud fraction (0-100%) in each 500m pixel

Jan 15-21, 2008 CONUS WELD tiles



**ACCA**

500m browse: cloud fraction (0-100%) in each 500m pixel  
Jan 15-21, 2008 CONUS WELD tiles



## V1.5 WELD Cloud Tree Algorithm

500m browse: cloud fraction (0-100%) in each 500m pixel

Jan 15-21, 2008 CONUS WELD tiles

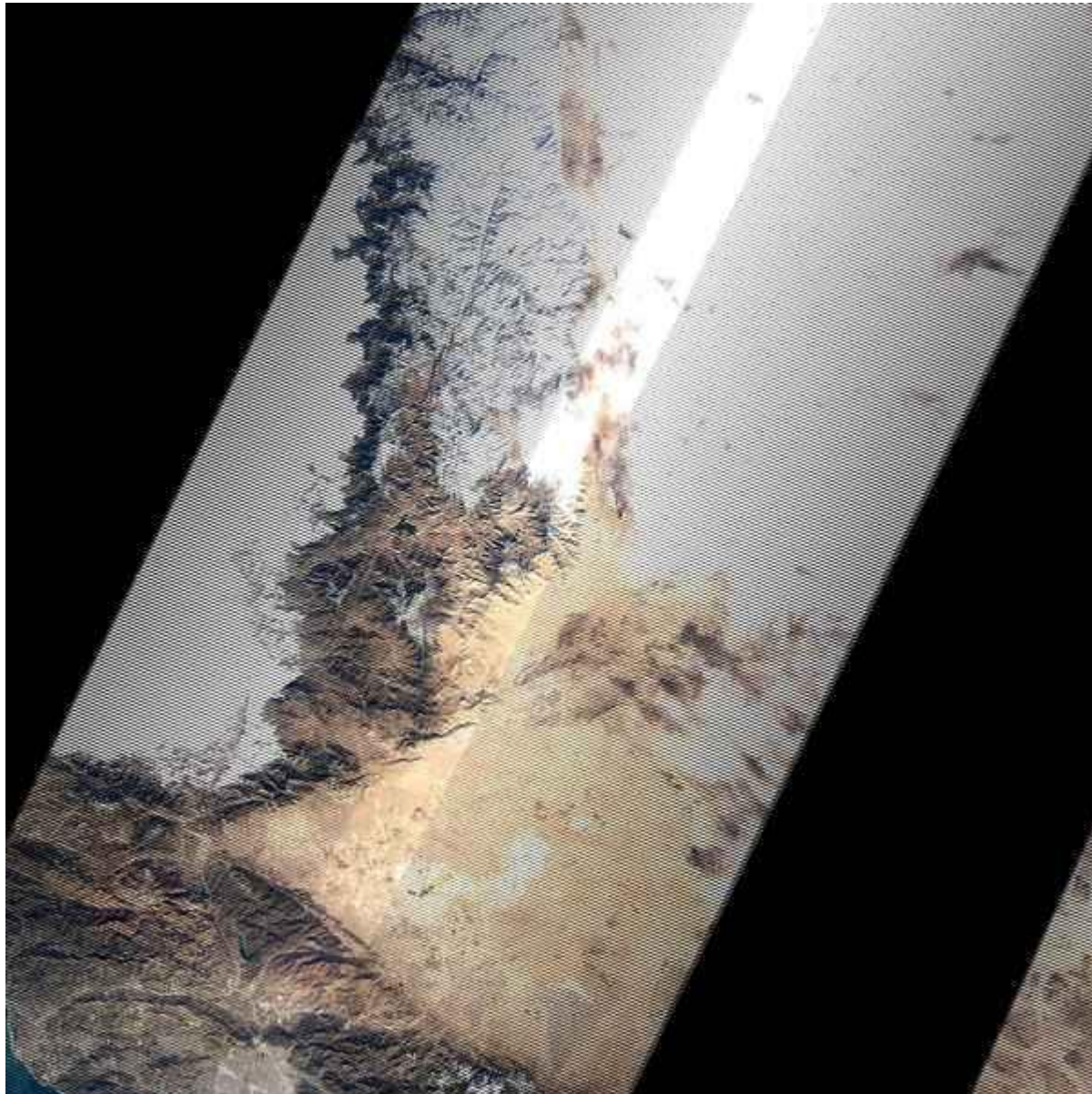


# Fmask

## Spatial Subset Location



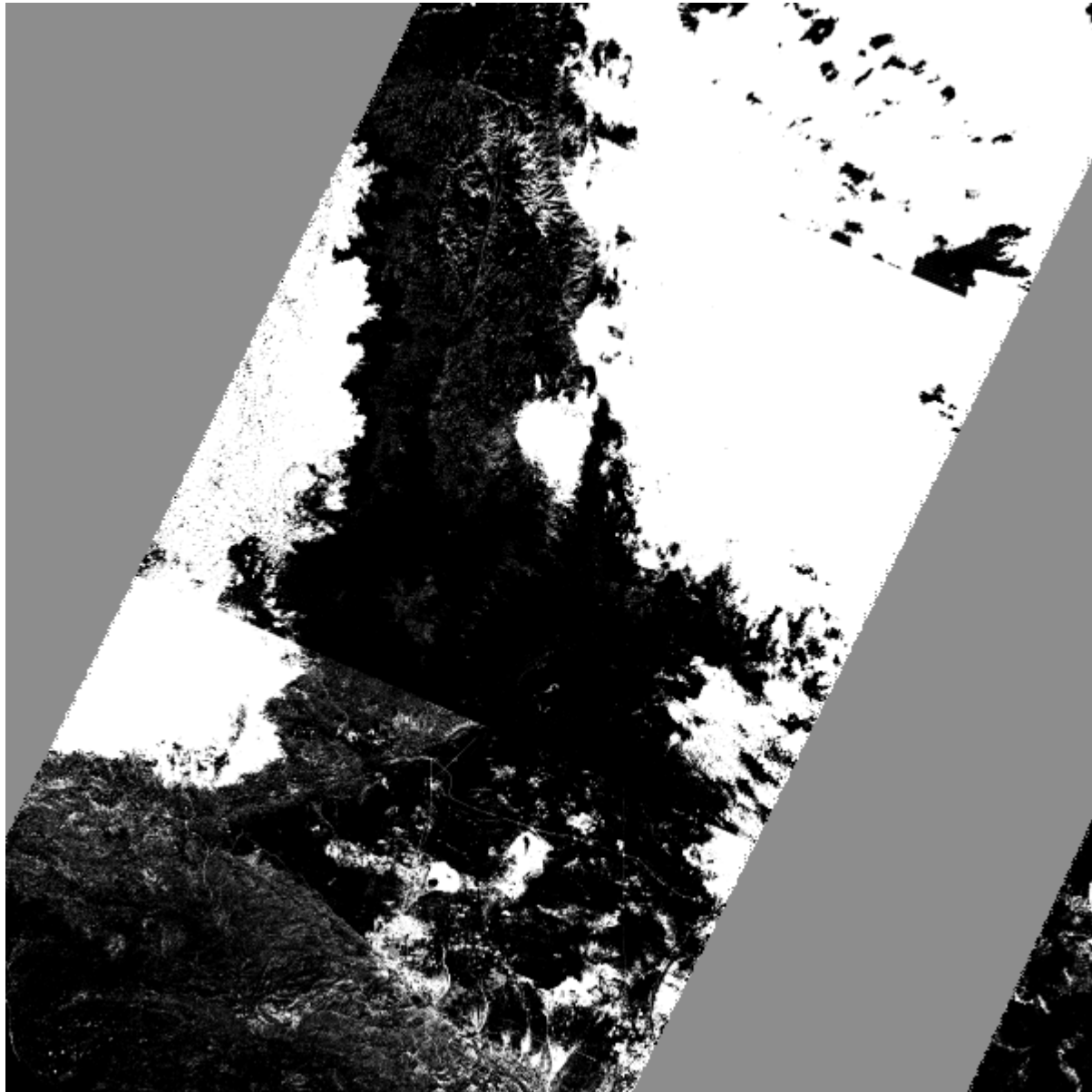
**Spatial Subset V1.5 WELD TOA True Color 30m Reflectance**  
**Jan 15-21, 2008 CONUS (10217x10217 30m pixels)**



Fmask



**ACCA**



## V1.5 WELD Cloud Tree Algorithm

